BULK RATE
U.S. POSTAGE PAID
Permit No. 136
Sun Valley, CA

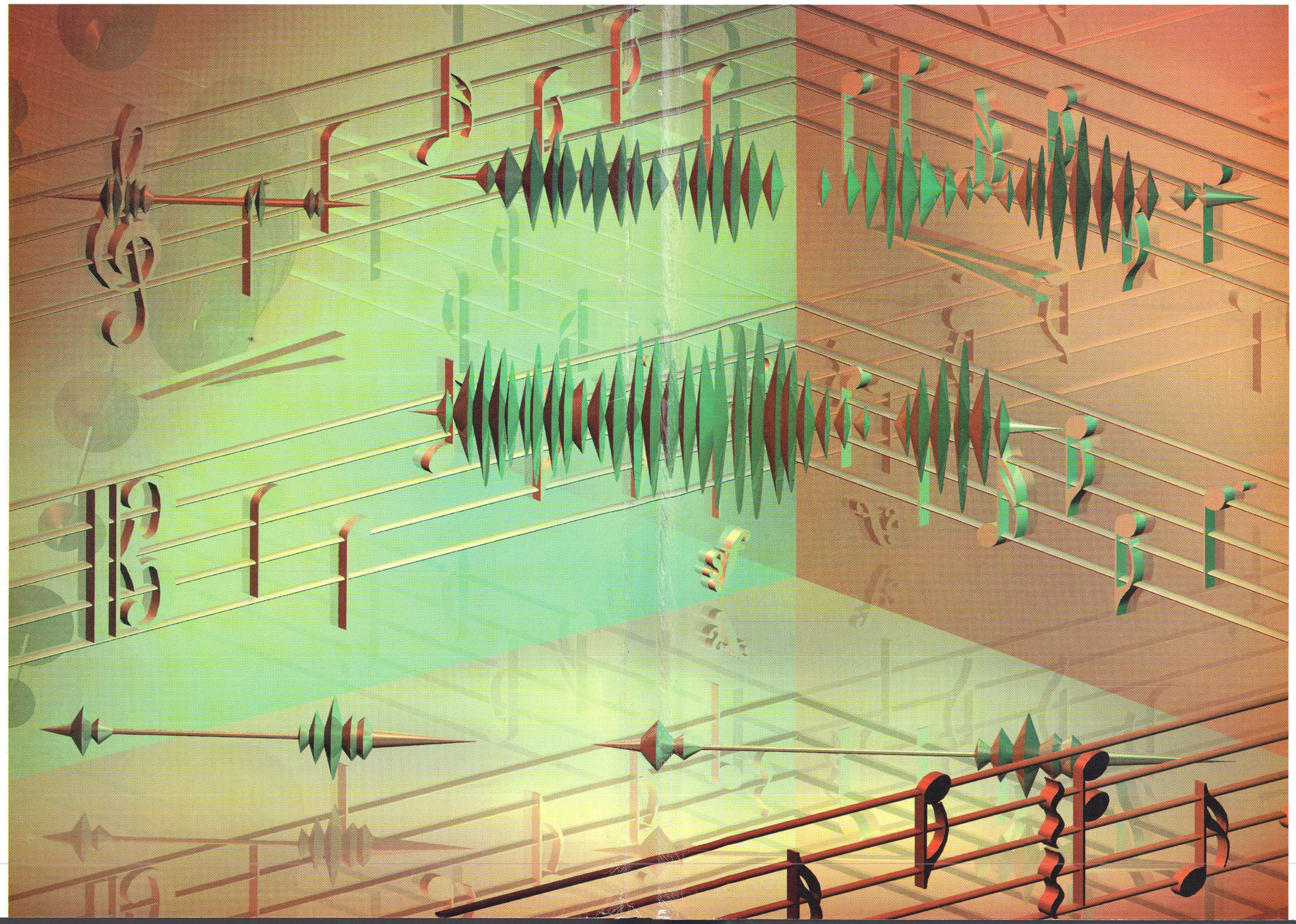
$10.00
1047-0735

Printed on recycled paper

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

develop Issue 11

11



develop

The Apple Technical Journal

THE ASYNCHRONOUS SOUND HELPER

AROUND AND AROUND: MULTIBUFFERING SOUNDS

LIVING IN AN EXCEPTIONAL WORLD

THE NETWORK PROJECT: DISTRIBUTED COMPUTING ON THE MACINTOSH

WRITING DIRECTLY TO THE SCREEN

KON & BAL'S PUZZLE PAGE

MACINTOSH Q & A

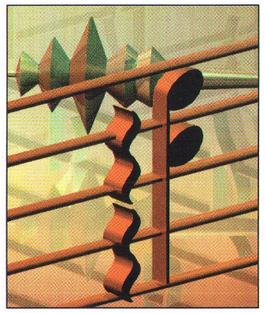
Issue 11 August 1992

EDITORIAL STAFF

Editor-in-Cheek *Caroline Rose*
Technical Buckstopper *Dave Johnson*
Our Boss *Greg Joswiak*
His Boss *David Krathwohl*
Review Board *Pete ("Luke") Alexander, Neil Day, C. K. Haun, Jim Reekes, Bryan K. ("Beaker") Ressler, Larry Rosenstein, Andy Shebanow, Gregg Williams*
Managing Editor *Monica Meffert*
Assistant Managing Editor *Ana Wilczynski*
Contributing Editors *Lorraine Anderson, Toni Haskell, Judy Helfand, Rebecca Pepper, Rilla Reynolds*
Indexer *Ira Kleinberg*

ART & PRODUCTION

Production Manager *Hartley Lesser*
Art Director *Diane Wilcox*
Technical Illustration *Nurit Arbel, John Ryan*
Formatting *Forbes Mill Press*
Printing *Wolfer Printing Company, Inc.*
Film Preparation *Aptos Post, Inc.*
Production *PrePress Assembly*
Photography *Sharon Beals, Lisa Jongewaard*



Cleo Huggins of Rucker Huggins used Ray Dream Designer 2.0 to orchestrate this 3-D score of sound and music. The music symbols are characters from Sonata, a noteworthy typeface that Cleo designed at Adobe Systems.

develop, *The Apple Technical Journal*, is a quarterly publication of the Developer Support Systems and Communications group.

The *Developer CD Series* disc for August 1992 or later contains this issue and all back issues of *develop* along with the code that the articles describe. The *develop* issues and code are also available on AppleLink and via anonymous ftp on ftp.apple.com.

RESOURCES

Apple provides a wealth of information, products, and services to assist developers. The Apple Programmers and Developers Association (APDA) and Apple Developer University are open to anyone who wants access to development tools and instruction. Qualified developers of commercial products in the U.S. and Canada may access additional information and services through the Apple Associates and Partners programs.

The Associates Program, Apple's mainstream program for developers of commercial products, is a convenient and cost-effective way to get essential technical and marketing information. This program offers self-help technical support, keeps you up to date with the latest products and technical documentation, and gives you access to the Apple developer community through AppleLink. Associates also receive discounts on equipment. The Associates program is designed for developers of commercial Apple-compatible products.

The Partners Program is open to Apple-selected developers of commercial products. In addition to receiving the same development information and tools as Associates, Partners receive technical support via electronic mail. Membership in the Partners program is limited to developers who directly contribute to Apple's long-term product strategies and business objectives.

APDA offers convenient worldwide access to development tools, resources, training products, and information for anyone interested in developing applications on Apple platforms. Customers receive the quarterly *APDA Tools Catalog* featuring over 300 Apple and third-party development products. There are no membership fees. APDA offers convenient payment and shipping options, including site licensing. Apple Associates or Partners automatically receive the *APDA Tools Catalog*.

Apple Developer University provides training for all levels of Macintosh programmers. Developer University classes give you experience using the most up-to-date development tools. Developer University offers classes at U.S. and international locations and through authorized third parties. On-site instruction can also be arranged for selected courses. Multimedia self-paced courses are available from Developer University through APDA. These courses include Macintosh Programming Fundamentals, User-Centered Design, Introduction to Object-Oriented Programming, and AppleTalk for Programmers.

Apple Associates and Partners Programs Call the Developer Support Center at (408)974-4897, AppleLink DEVSUPPORT, or write 20525 Mariani Avenue, M/S 75-2C, Cupertino, CA 95014, for information or an application form for the Associates or Partners program. Developers outside the U.S. and Canada should instead contact the Apple office in their country for information about developer programs.

APDA To order products or to receive a complimentary catalog, call 1-800-282-2732 in the U.S., 1-800-637-0029 in Canada, (408)562-3910 internationally, or (408)562-3971 for fax. You can also order electronically (AppleLink APDA; Internet APDA@applelink.apple.com; CompuServe 76666,2405; Telex 171-576; GEnie A.DEVELOPER3; or America Online APDA Sale) or write 20525 Mariani Avenue, M/S 33-G, Cupertino, CA 95014.

Apple Developer University The registrar at (408)974-6215 can reserve your place or send a current curriculum guide and course schedule. You can also AppleLink DEVUNIV or write 20525 Mariani Avenue, M/S 75-6U, Cupertino, CA 95014. Self-paced products should be ordered directly through APDA.

BULK RATE
U.S. POSTAGE
PAID
LOS ANGELES, CA
PERMIT #1831

$10.00
1047-0735

Printed on recycled paper

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

develop Issue 12

12

develop

The Apple Technical Journal

TECHNIQUES FOR WRITING AND DEBUGGING COMPONENTS

TIME BASES: THE HEARTBEAT OF QUICKTIME

BETTER APPLE EVENT CODING THROUGH OBJECTS

ANOTHER TAKE ON GLOBALS IN STANDALONE CODE

COMPONENTS AND C++ CLASSES COMPARED

ANIMATION AT A GLANCE

TOP 10 PRINTING MISDEMEANORS

KON & BAL'S PUZZLE PAGE

MACINTOSH Q & A

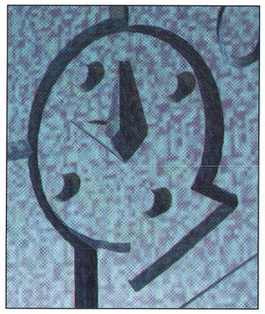
Issue 12 December 1992

EDITORIAL STAFF

Editor-in-Cheek *Caroline Rose*
Technical Buckstopper *Dave Johnson*
Our Boss *Greg Joswiak*
His Boss *David Krathwohl*
Review Board *Pete ("Luke") Alexander, Neil Day, C. K. Haun, Jim Reekes, Bryan K. ("Beaker") Ressler, Larry Rosenstein, Andy Shebanow, Gregg Williams*
Managing Editor *Monica Meffert*
Assistant Managing Editor *Ana Wilczynski*
Contributing Editors *Lorraine Anderson, Geta Carlson, Toni Haskell, Judy Helfand, Rebecca Pepper, Rilla Reynolds*
Indexer *Ira Kleinberg*

ART & PRODUCTION

Production Manager *Hartley Lesser*
Art Director *Diane Wilcox*
Technical Illustration *Nurit Arbel, John Ryan*
Formatting *Forbes Mill Press*
Printing *Wolfer Printing Company, Inc.*
Film Preparation *Aptos Post, Inc.*
Production *PrePress Assembly*
Photography *Sharon Beals, Lisa Jongewaard*



The stone jigsaw puzzle was pieced together by Hal Rucker of Rucker Huggins using Adobe Illustrator, FontMonger, Ray Dream Designer 2.0, and Adobe Photoshop.

develop, The Apple Technical Journal, is a quarterly publication of the Developer Support Information group.

The *Developer CD Series* disc for November/December 1992 or later contains this issue and all back issues of *develop* along with the code that the articles describe. The *develop* issues and code are also available on AppleLink and via anonymous ftp on ftp.apple.com.

RESOURCES

Apple provides a wealth of information, products, and services to assist developers. APDA, Apple's source for developer tools, and Apple Developer University are open to anyone who wants access to development tools and instruction. Qualified developers of commercial products in the U.S. and Canada may access additional information and services through the Apple Associates and Partners programs.

The Associates Program, Apple's mainstream program for developers of commercial products, is a convenient and cost-effective way to get essential technical and marketing information. This program offers self-help technical support, keeps you up to date with the latest products and technical documentation, and gives you access to the Apple developer community through AppleLink. Associates also receive discounts on equipment. The Associates program is designed for developers of commercial Apple-compatible products.

The Partners Program is open to Apple-selected developers of commercial products. In addition to receiving the same development information and tools as Associates, Partners receive technical support via electronic mail. Membership in the Partners program is limited to developers who directly contribute to Apple's long-term product strategies and business objectives.

APDA offers convenient worldwide access to development tools, resources, training products, and information for anyone interested in developing applications on Apple platforms. Customers receive the quarterly *APDA Tools Catalog* featuring over 300 Apple and third-party development products. There are no membership fees. APDA offers convenient payment and shipping options, including site licensing. Apple Associates or Partners automatically receive the *APDA Tools Catalog*.

Apple Developer University provides training for all levels of Macintosh programmers. Developer University classes give you experience using the most up-to-date development tools. Developer University offers classes at U.S. and international locations and through authorized third parties. On-site instruction can also be arranged for selected courses. Multimedia self-paced courses are available from Developer University through APDA. These courses include Macintosh Programming Fundamentals, User-Centered Design, Introduction to Object-Oriented Programming, and AppleTalk for Programmers.

Apple Associates and Partners Programs Call the Developer Support Center at (408)974-4897, AppleLink DEVSUPPORT, or write 20525 Mariani Avenue, M/S 75-2C, Cupertino, CA 95014, for information or an application form for the Associates or Partners program. Developers outside the U.S. and Canada should instead contact the Apple office in their country for information about developer programs.

APDA To order products or to receive a complimentary catalog, call 1-800-282-2732 in the U.S., 1-800-637-0029 in Canada, (716)871-6555 internationally, or (716)871-6511 for fax. You can also order electronically (AppleLink APDA; Internet APDA@applelink.apple.com; CompuServe 76666,2405; or America Online APDA) or write APDA, Apple Computer, Inc., P.O. Box 319, Buffalo, NY 14207-0319.

Apple Developer University The registrar at (408)974-6215 can reserve your place or send a current curriculum guide and course schedule. You can also AppleLink DEVUNIV or write 20525 Mariani Avenue, M/S 75-6U, Cupertino, CA 95014. Self-paced products should be ordered directly through APDA.

BULK RATE
U.S. POSTAGE PAID
Los Angeles, CA
Permit No. 1831

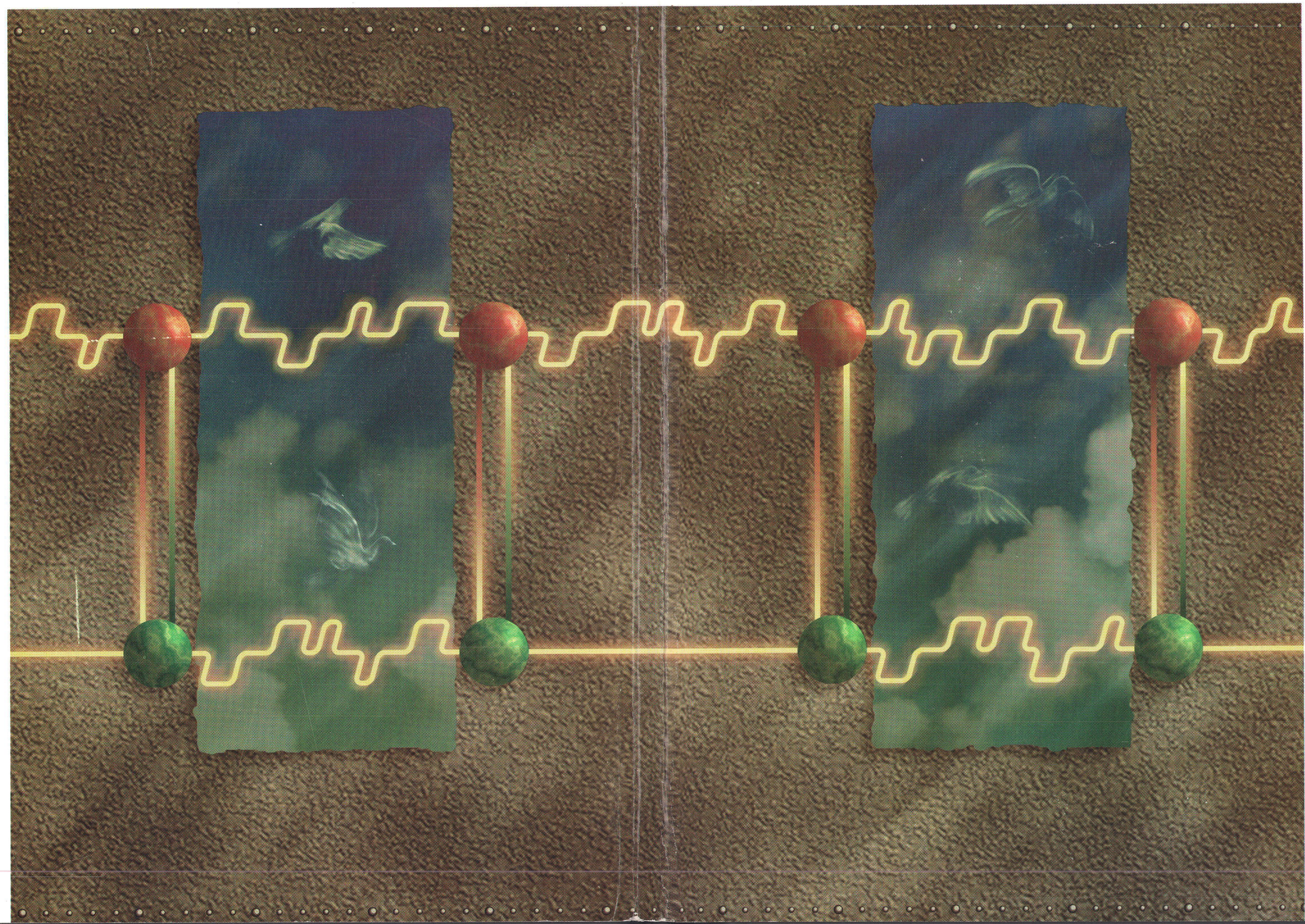
$10.00
1047-0735

Printed on recycled paper

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

develop Issue 13

13



develop

The Apple Technical Journal

ASYNCHRONOUS ROUTINES ON THE MACINTOSH

INSIDE QUICKTIME AND COMPONENT-BASED MANAGERS

MACINTOSH DEBUGGING: THE BELLY OF THE BEAST REVISITED

ADVENTURES IN COLOR PRINTING

DEVICELOOP MEETS THE INTERFACE DESIGNER

LOOKING AHEAD TO PRINTING IN QUICKDRAW GX

THE PALETTE MANAGER WAY

KON & BAL'S PUZZLE PAGE

MACINTOSH Q & A

NEW QUICKTIME COLUMN: TOP 10 QUICKTIME TIPS

Issue 13 March 1993

EDITORIAL STAFF

Editor-in-Cheek *Caroline Rose*
Technical Buckstopper *Dave Johnson*
Our Boss *Greg Joswiak*
His Boss *David Krathwohl*
Review Board *Pete ("Luke") Alexander, Neil Day, C. K. Haun, Jim Reekes, Bryan K. ("Beaker") Ressler, Larry Rosenstein, Andy Shebanow, Gregg Williams*
Managing Editor *Monica Meffert*
Assistant Managing Editor *Cynthia Jasper*
Contributing Editors *Lorraine Anderson, Geta Carlson, Toni Haskell, Judy Helfand, Rilla Reynolds*
Indexer *Ira Kleinberg*

ART & PRODUCTION

Production Manager *Hartley Lesser*
Art Director *Diane Wilcox*
Technical Illustration *Dave Olmos, John Ryan*
Formatting *Forbes Mill Press*
Printing *Wolfer Printing Company, Inc.*
Film Preparation *Aptos Post, Inc.*
Production *PrePress Assembly*
Photography *Sharon Beals, Lisa Jongewaard, Tom Sandborn*

Mark Jenkins of Rucker Huggins created this beautiful image depicting asynchronous routines by synchronizing four graphics applications: Adobe Photoshop, Adobe Illustrator, Ray Dream Designer, and Fractal Design Painter.

develop, The Apple Technical Journal, is a quarterly publication of Apple Computer's Developer Support Information group.

The *Developer CD Series* disc for March 1993 or later contains this issue and all back issues of *develop* along with the code that the articles describe. The *develop* issues and code are also available on AppleLink and via anonymous ftp on ftp.apple.com.

RESOURCES

Apple provides a wealth of information, products, and services to assist developers. APDA, Apple's source for developer tools, and Apple Developer University are open to anyone who wants access to development tools and instruction. Qualified developers of commercial products in the U.S. and Canada may access additional information and services through the Apple Associates and Partners programs.

The Associates Program, Apple's mainstream program for developers of commercial products, is a convenient and cost-effective way to get essential technical and marketing information. This program offers self-help technical support, keeps you up to date with the latest products and technical documentation, and gives you access to the Apple developer community through AppleLink. Associates also receive discounts on equipment. The Associates program is designed for developers of commercial Apple-compatible products.

The Partners Program is open to Apple-selected developers of commercial products. In addition to receiving the same development information and tools as Associates, Partners receive technical support via electronic mail. Membership in the Partners program is limited to developers who directly contribute to Apple's long-term product strategies and business objectives.

APDA offers convenient worldwide access to development tools, resources, training products, and information for anyone interested in developing applications on Apple platforms. Customers receive the quarterly *APDA Tools Catalog* featuring over 300 Apple and third-party development products. There are no membership fees. APDA offers convenient payment and shipping options, including site licensing. Apple Associates or Partners automatically receive the *APDA Tools Catalog*.

Apple Developer University (DU) provides training for all levels of Macintosh programmers. Developer University classes give you experience using the most up-to-date development tools. Developer University offers classes at U.S. and international locations and through DU Extension partners. On-site instruction can also be arranged for selected courses. Multimedia self-paced courses are available from Developer University through APDA. DU course offerings include System 7 extensions, object-oriented and procedural programming, and new technologies, such as PowerPC.

Apple Associates and Partners Programs Call the Developer Support Center at (408)974-4897, AppleLink DEVSUPPORT, or write 20525 Mariani Avenue, M/S 75-2C, Cupertino, CA 95014, for information or an application form for the Associates or Partners program. Developers outside the U.S. and Canada should instead contact the Apple office in their country for information about developer programs.

APDA To order products or to receive a complimentary catalog, call 1-800-282-2732 in the U.S., 1-800-637-0029 in Canada, (716)871-6555 internationally, or (716)871-6511 for fax. You can also order electronically (AppleLink APDA; Internet APDA@applelink.apple.com; CompuServe 76666,2405; or America Online APDA) or write APDA, Apple Computer, Inc., P.O. Box 319, Buffalo, NY 14207-0319.

Apple Developer University The registrar at (408)974-6215 can reserve your place or send a current Curriculum Guide and Course Schedule. You can also AppleLink DEVUNIV or write 20525 Mariani Avenue, M/S 75-6U, Cupertino, CA 95014. Self-paced products should be ordered directly through APDA.

BULK RATE
U.S. POSTAGE PAID
Los Angeles, CA
Permit No. 1831

14

$10.00
1047-0735

Printed on recycled paper

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

develop Issue 14

develop

The Apple Technical Journal

WRITING LOCALIZABLE APPLICATIONS

3-D ROTATION USING A 2-D INPUT DEVICE

VIDEO DIGITIZING UNDER QUICKTIME

MAKING BETTER QUICKTIME MOVIES

SYNCING UP WITH COLORSYNC

FOUR COMMON GRAPHICS ANSWERS

DERIVED MEDIA HANDLERS

SYSTEM ENABLERS

KON & BAL'S PUZZLE PAGE

MACINTOSH Q & A

Issue 14 June 1993

EDITORIAL STAFF

Editor-in-Cheek *Caroline Rose*
Technical Buckstopper *Dave Johnson*
Our Boss *Greg Joswiak*
His Boss *Dennis Matthews*
Review Board *Pete ("Luke") Alexander, Neil Day, C. K. Haun, Jim Reekes, Bryan K. ("Beaker") Ressler, Larry Rosenstein, Andy Shebanow, Gregg Williams*
Managing Editor *Cynthia Jasper*
Contributing Editors *Lorraine Anderson, Geta Carlson, Toni Haskell, Judy Helfand, Rebecca Pepper, Rilla Reynolds*
Indexer *Ira Kleinberg*

ART & PRODUCTION

Production Manager *Hartley Lesser*
Art Director *Diane Wilcox*
Technical Illustration *Nurit Arbel, John Ryan*
Formatting *Forbes Mill Press*
Printing *Wolfer Printing Company, Inc.*
Film Preparation *Aptos Post, Inc.*
Production *PrePress Assembly*
Photography *Sharon Beals*

Maria Mortati of Rucker Huggins created this cover to illustrate the international aspects of writing localizable applications. She used Adobe Photoshop, Adobe Illustrator, and a box of colored pencils.

develop, The Apple Technical Journal, is a quarterly publication of Apple Computer's Developer Press group.

The *develop Bookmark* CD or the *Developer CD Series* disc for June 1993 or later contains this issue and all back issues of *develop* along with the code that the articles describe. The *develop* issues and code are also available on AppleLink and via anonymous ftp on ftp.apple.com.

RESOURCES

Apple provides a wealth of information, products, and services to assist developers. APDA, Apple's source for developer tools, and Apple Developer University are open to anyone who wants access to development tools and instruction. Qualified developers of commercial products in the U.S. and Canada may access additional information and services through the Apple Associates and Partners programs.

The Associates Program, Apple's mainstream program for developers of commercial products, is a convenient and cost-effective way to get essential technical and marketing information. This program offers self-help technical support, keeps you up to date with the latest products and technical documentation, and gives you access to the Apple developer community through AppleLink. Associates also receive discounts on equipment. The Associates program is designed for developers of commercial Apple-compatible products.

The Partners Program is open to Apple-selected developers of commercial products. In addition to receiving the same development information and tools as Associates, Partners receive technical support via electronic mail. Membership in the Partners program is limited to developers who directly contribute to Apple's long-term product strategies and business objectives.

APDA offers convenient worldwide access to development tools, resources, training products, and information for anyone interested in developing applications on Apple platforms. Customers receive the quarterly *APDA Tools Catalog* featuring over 300 Apple and third-party development products. There are no membership fees. APDA offers convenient payment and shipping options, including site licensing. Apple Associates or Partners automatically receive the *APDA Tools Catalog*.

Apple Developer University (DU) provides training for all levels of Macintosh programmers. Developer University classes give you experience using the most up-to-date development tools. Developer University offers classes at U.S. and international locations and through DU Extension partners. On-site instruction can also be arranged for selected courses. Multimedia self-paced courses are available from Developer University through APDA. DU course offerings include System 7 extensions, object-oriented and procedural programming, and new technologies, such as PowerPC.

Apple Associates and Partners Programs Call the Developer Support Center at (408)974-4897, AppleLink DEVSUPPORT, or write 20525 Mariani Avenue, M/S 75-2C, Cupertino, CA 95014, for information or an application form for the Associates or Partners program. Developers outside the U.S. and Canada should instead contact the Apple office in their country for information about developer programs.

APDA To order products or to receive a complimentary catalog, call 1-800-282-2732 in the U.S., 1-800-637-0029 in Canada, (716)871-6555 internationally, or (716)871-6511 for fax. You can also order electronically (AppleLink APDA; Internet APDA@applelink.apple.com; CompuServe 76666,2405; or America Online APDA) or write APDA, Apple Computer, Inc., P.O. Box 319, Buffalo, NY 14207-0319.

Apple Developer University The registrar at (408)974-6215 can reserve your place or send a current Curriculum Guide and Course Schedule. You can also AppleLink DEVUNIV or write 20525 Mariani Avenue, M/S 75-6U, Cupertino, CA 95014. Self-paced products should be ordered directly through APDA.

BULK RATE
U.S. POSTAGE PAID
Los Angeles, CA
Permit No. 1831

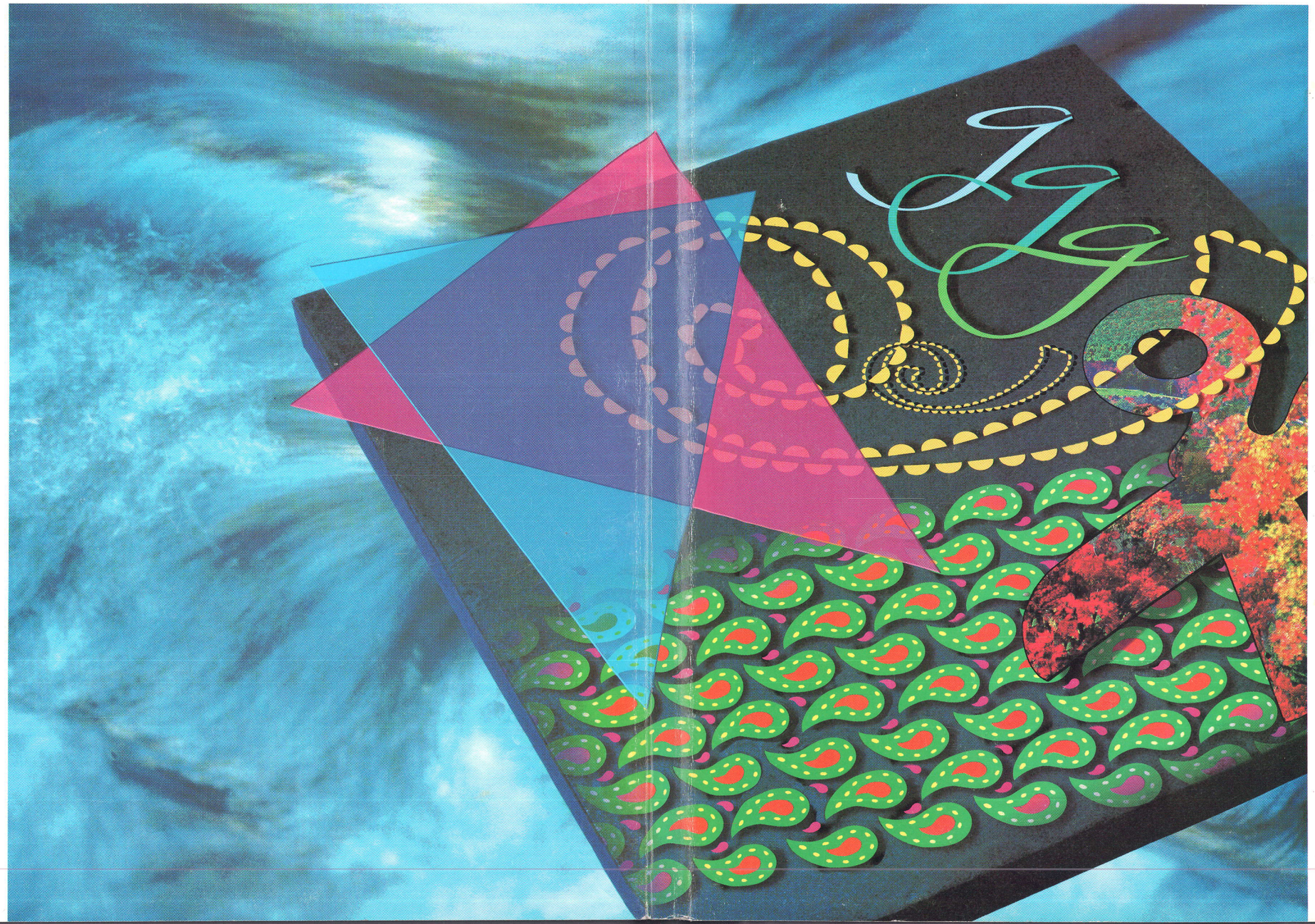
$10.00
1047-0735

Printed on recycled paper

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

develop Issue 15

15



develop

The Apple Technical Journal

GETTING STARTED WITH QUICKDRAW GX

DEVELOPING QUICKDRAW GX PRINTING EXTENSIONS

QUICKDRAW GX FOR POSTSCRIPT PROGRAMMERS

MANAGING COMPONENT REGISTRATION

DYNAMIC CUSTOMIZATION OF COMPONENTS

FLOATING WINDOWS: KEEPING AFLOAT IN THE WINDOW MANAGER

WORKING IN THE THIRD DIMENSION

KON & BAL'S PUZZLE PAGE

MACINTOSH Q & A

Issue 15 September 1993

EDITORIAL STAFF

Editor-in-Cheek *Caroline Rose*
Technical Buckstopper *Dave Johnson*
Our Boss *Greg Joswiak*
His Boss *Dennis Matthews*
Review Board *Pete ("Luke") Alexander, Neil Day, C. K. Haun, Jim Reekes, Bryan K. ("Beaker") Ressler, Larry Rosenstein, Andy Shebanow, Gregg Williams*
Managing Editor *Cynthia Jasper*
Contributing Editors *Lorraine Anderson, Philip Borenstein, Robin Cowan, Toni Haskell, Judy Helfand, Rebecca Pepper, Rilla Reynolds*
Indexer *Ira Kleinberg*

ART & PRODUCTION

Production/Art Director *Diane Wilcox*
Technical Illustration *Dave Olmos, John Ryan*
Formatting *Forbes Mill Press*
Printing *Wolfer Printing Company, Inc.*
Film Preparation *Aptos Post, Inc.*
Production *PrePress Assembly*
Photography *Sharon Beals*

Lindsay Marshall of Rucker Huggins illustrated several QuickDraw GX features for this cover. The three *g*'s are from the "GX-ready" typeface, Columbine, developed by David Siegel.

develop, The Apple Technical Journal, a quarterly publication of Apple Computer's Developer Press group, is published in March, June, September, and December.

The *develop Bookmark* CD (or the *Developer CD Series* disc, Reference Library edition) for September 1993 or later contains this issue and all back issues of *develop* along with the code that the articles describe. The *develop* issues and code are also available on AppleLink and via anonymous ftp on ftp.apple.com.

RESOURCES

Apple provides a wealth of information, products, and services to assist developers. APDA, Apple's source for developer tools, and Apple Developer University are open to anyone who wants access to development tools and instruction. Qualified developers may access additional information and services through the Apple Associates and Partners programs.

The Associates Program, Apple's mainstream program for developers, is a convenient and cost-effective way to get essential technical and marketing information. This program offers self-help technical support, keeps you up to date with the latest products and technical documentation, and gives you access to the Apple developer community through AppleLink. Associates also receive discounts on equipment.

The Partners Program is open to Apple-selected developers. In addition to receiving the same development information and tools as Associates, Partners receive technical support via electronic mail. Membership in the Partners program is limited to strategic developers who directly contribute to Apple's long-term product plans and business objectives.

APDA offers convenient worldwide access to development tools, resources, training products, and information for anyone interested in developing applications on Apple platforms. Customers receive the quarterly *APDA Tools Catalog* featuring over 300 Apple and third-party development products. There are no membership fees. APDA offers convenient payment and shipping options, including site licensing. Apple Associates or Partners automatically receive the *APDA Tools Catalog*.

Apple Developer University (DU) provides training for all levels of Macintosh programmers. Developer University classes give you experience using the most up-to-date development tools. Developer University offers classes at U.S. and international locations and through DU Extension partners. On-site instruction can also be arranged for selected courses. Multimedia self-paced courses are available from Developer University through APDA. DU course offerings include System 7 extensions, object-oriented and procedural programming, and new technologies, such as PowerPC.

Apple Associates and Partners Programs Call the Developer Support Center at (408)974-4897, AppleLink DEVSUPPORT, or write 20525 Mariani Avenue, M/S 303-2T, Cupertino, CA 95014, for information or an application form for the Associates or Partners program. Developers outside the U.S. and Canada should instead contact the Apple office in their country for information about developer programs.

APDA To order products or to receive a complimentary catalog, call 1-800-282-2732 in the U.S., 1-800-637-0029 in Canada, (716)871-6555 internationally, or (716)871-6511 for fax. You can also order electronically (AppleLink APDA; Internet APDA@applelink.apple.com; CompuServe 76666,2405; or America Online APDA) or write APDA, Apple Computer, Inc., P.O. Box 319, Buffalo, NY 14207-0319.

Apple Developer University The registrar at (408)974-6215 can reserve your place or send a current Curriculum Guide and Course Schedule. You can also AppleLink DEVUNIV or write 20525 Mariani Avenue, M/S 305-1TU, Cupertino, CA 95014. Self-paced products should be ordered directly through APDA.

BULK RATE
U.S. POSTAGE PAID
Los Angeles, CA
Permit No. 1831

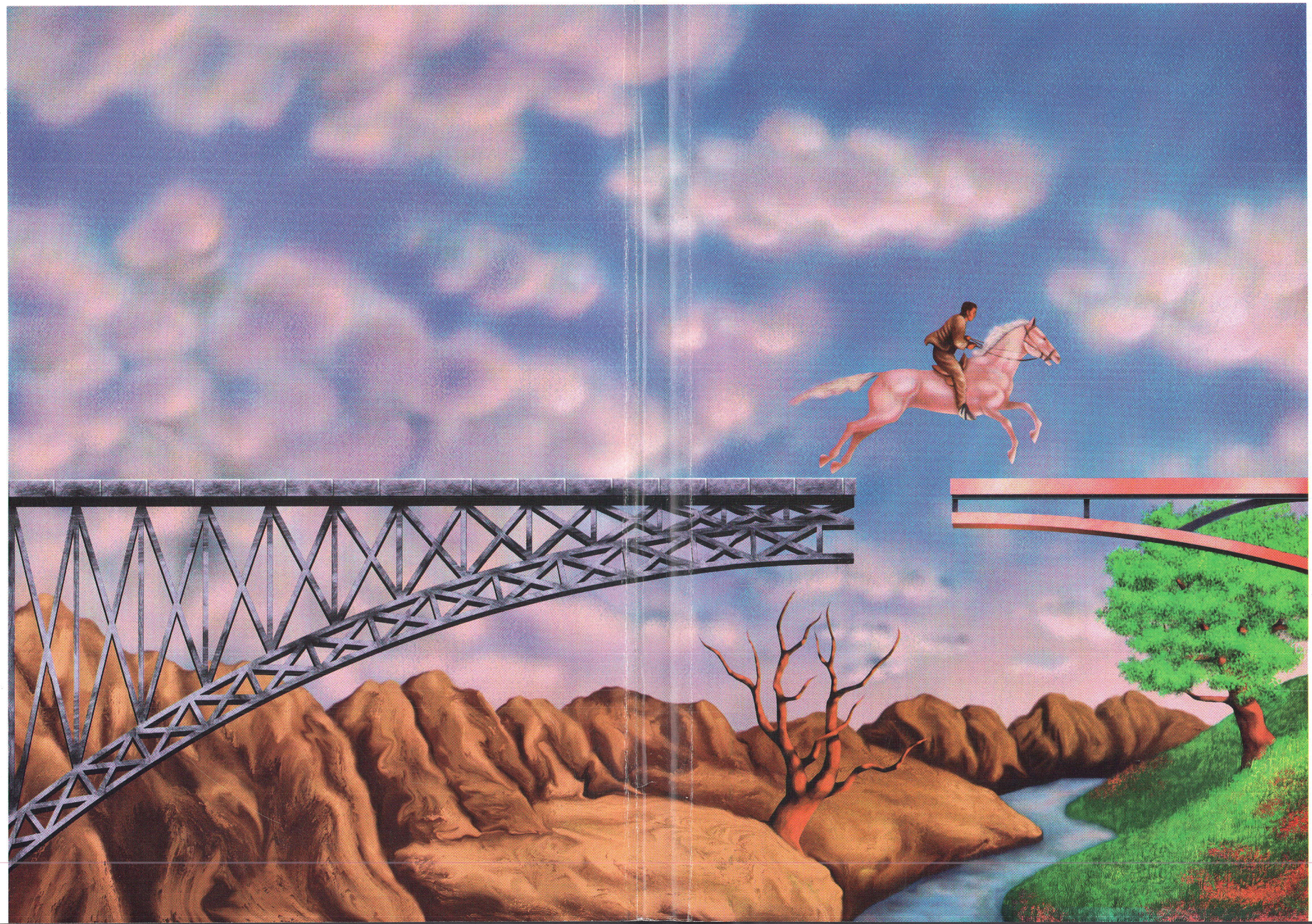
$10.00
1047-0735

Printed on recycled paper

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

develop Issue 16

16



develop

The Apple Technical Journal

MAKING THE LEAP TO POWERPC

BUILDING POWERTALK-SAVVY APPLICATIONS

DRAG AND DROP FROM THE FINDER

COLOR MATCHING MADE EASY WITH QUICKDRAW GX

INTERNATIONAL NUMBER FORMATTING

WHAT'S NEW WITH SOUND MANAGER 3.0

LASERWRITER 8 FOR FUN AND PROFIT

REMEDIES FOR COMMON QUICKDRAW PROBLEMS

KON & BAL'S PUZZLE PAGE

MACINTOSH Q & A

Issue 16 December 1993

EDITORIAL STAFF

Editor-in-Cheek *Caroline Rose*

Technical Buckstopper *Dave Johnson*

Our Boss *Greg Joswiak*

His Boss *Dennis Matthews*

Review Board *Pete ("Luke") Alexander, C. K. Haun, Jim Reekes, Bryan K. ("Beaker") Ressler, Larry Rosenstein, Andy Shebanow, Gregg Williams*

Managing Editor *Cynthia Jasper*

Contributing Editors *Lorraine Anderson, Philip Borenstein, Robin Cowan, Matt Deatherage, Toni Haskell, Judy Helfand, Rebecca Pepper*

Indexer *Marc Savage*

Special thanks to Smart Friend Dean Yu for his help during Dave Johnson's sabbatical.

ART & PRODUCTION

Production/Art Director *Diane Wilcox*

Technical Illustration *Dave Olmos, John Ryan*

Formatting *Forbes Mill Press*

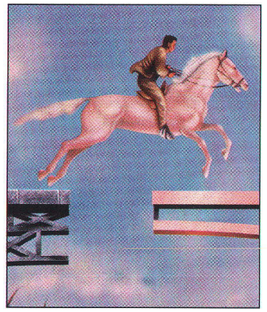
Printing *Wolfer Printing Company, Inc.*

Film Preparation *Aptos Post, Inc.*

Production *PrePress Assembly*

Photography *Sharon Beals*

develop, The Apple Technical Journal, a quarterly publication of Apple Computer's Developer Press group, is published in March, June, September, and December.



The cover. Mark Jenkins of Rucker Huggins Design created this cover using Adobe Photoshop, Adobe Illustrator, Fractal Design Painter, and a Macintosh Quadra 950. He looks forward to making the leap himself to Macintosh on PowerPC.

This issue's CD. The *develop Bookmark* CD (or the *Developer CD Series* disc, Reference Library edition) for December 1993 or later contains this issue and all back issues of *develop* along with the code that the articles describe. The *develop* issues and code are also available on AppleLink and via anonymous ftp on ftp.apple.com. Note that some software and documentation referred to as being on this issue's CD may be located on the Tool Chest edition rather than the Reference Library edition of the *Developer CD Series* disc.

RESOURCES

Apple provides a wealth of information, products, and services to assist developers. APDA, Apple's source for developer tools, and Apple Developer University are open to anyone who wants access to development tools and instruction. Developers may access additional information and services through the Apple Associates and Partners programs.

The Associates Program is Apple's primary program for developers across all Apple technologies, including Macintosh, PIE (personal interactive electronics, such as Newton), and multimedia. It's designed as a low-cost, self-support program, and also provides a connection with Apple and fellow developers, information on new technologies, and discounts on equipment.

The Partners Program is open to Apple-selected developers. In addition to receiving the same development information and tools as Associates, Partners receive expert development support via electronic mail. Membership in the Partners program is limited to strategic developers who directly contribute to Apple's long-term product plans and business objectives.

APDA offers convenient worldwide access to development tools, resources, training products, and information for anyone interested in developing applications on Apple platforms. Customers receive the quarterly *APDA Tools Catalog* featuring over 300 Apple and third-party development products. There are no membership fees. APDA offers convenient payment and shipping options, including site licensing. Apple Associates or Partners automatically receive the *APDA Tools Catalog*.

Apple Developer University (DU) provides software development courses designed to increase your development productivity. The curriculum includes courses to get you started programming on Apple platforms, as well as advanced, in-depth training on the newest Apple technologies, such as PowerPC, AOCE, QuickDraw GX, and Newton. DU offers courses in Cupertino CA and at selected training locations. The Developer University Extension partners located in Plano TX, Portsmouth NH, and Reston VA also schedule selected courses in their facilities. In addition to classroom training, DU offers multimedia self-paced courses and low-cost mini-course tutorials.

Apple Associates and Partners Programs Call the Developer Support Center at (408)974-4897, AppleLink DEVSUPPORT, or write 20525 Mariani Avenue, M/S 303-2T, Cupertino, CA 95014, for information or an application form for the Associates or Partners program. Developers outside the U.S. and Canada should instead contact the Apple office in their country for information about developer programs.

APDA To order products or to receive a complimentary catalog, call 1-800-282-2732 in the U.S., 1-800-637-0029 in Canada, (716)871-6555 internationally, or (716)871-6511 for fax. You can also order electronically (AppleLink APDA; Internet APDA@applelink.apple.com; CompuServe 76666,2405; or America Online APDAorder) or write APDA, Apple Computer, Inc., P.O. Box 319, Buffalo, NY 14207-0319.

Apple Developer University The registrar at (408)974-4897 can reserve your place or send a current Curriculum Guide and Course Schedule. You can also send an AppleLink to DEVUNIV or write Developer University, Apple Computer, Inc., 20525 Mariani Avenue, M/S 305-1TU, Cupertino, CA 95014. Self-paced products should be ordered directly through APDA.

BULK RATE
U.S. POSTAGE PAID
Los Angeles, CA
Permit No. 1831

$10.00
1047-0735

Printed on recycled paper

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

develop Issue 17

17

develop

The Apple Technical Journal

USING PROTO TEMPLATES ON THE NEWTON

STANDALONE CODE ON POWERPC

DEBUGGING ON POWERPC

CONCURRENT PROGRAMMING WITH THE THREAD MANAGER

WINDOW ZOOMING

TRACKING QUICKDRAW GX MESSAGES

CROSS-PLATFORM COMPATIBILITY AND MULTIPLE-MOVIE FILES

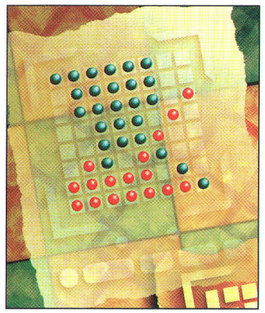
TEN TIPS FOR GAME DEVELOPERS

KON & BAL'S PUZZLE PAGE

HISTORY OF THE DOGCOW

MACINTOSH Q & A

Issue 17 March 1994



develop, The Apple Technical Journal, a quarterly publication of Apple Computer's Developer Press group, is published in March, June, September, and December.

This issue's CD. The *develop Bookmark* CD (or the *Developer CD Series* disc, Reference Library edition) for March 1994 or later contains this issue and all back issues of *develop* along with the code that the articles describe. The *develop* issues and code are also available on AppleLink and via anonymous ftp on ftp.apple.com. Note that some software and documentation referred to as being on this issue's CD may be located on the Tool Chest edition rather than the Reference Library edition of the *Developer CD Series* disc.

Macintosh Technical Notes. Where references to Macintosh Technical Notes in *develop* are followed by something like "(Memory 13)," this indicates the category and number of the Note on this issue's CD.

E-mail addresses. Most e-mail addresses mentioned in *develop* are AppleLink addresses; to convert an AppleLink address to an Internet address, append "@applelink.apple.com" to it. For example, DEVELOP on AppleLink converts to develop@applelink.apple.com on the Internet. To convert a NewtonMail address to an Internet address, append "@online.apple.com" to it.

EDITORIAL STAFF

Editor-in-Cheek *Caroline Rose*

Technical Buckstopper *Dave Johnson*

Our Boss *Greg Joswiak*

His Boss *Dennis Matthews*

Review Board *Pete ("Luke") Alexander, Jim Reekes, Bryan K. ("Beaker") Ressler, Larry Rosenstein, Andy Shebanow, Gregg Williams, Dean Yu*

Managing Editor *Cynthia Jasper*

Contributing Editors *Lorraine Anderson, Toni Haskell, Judy Helfand, Elaine Meyer, Rebecca Pepper*

Indexer *Marc Savage*

ART & PRODUCTION

Production/Art Director *Diane Wilcox*

Technical Illustration *Shawn Morningstar, John Ryan*

Formatting *Forbes Mill Press*

Film Services *Aptos Post, Inc.*

Prepress Production *PrePress Assembly*

Printing *Wolfer Printing Company, Inc.*

Photography *Sharon Beals*

Cover Illustration *Mark Jenkins of Rucker Huggins Design*

RESOURCES

Apple provides a wealth of information, products, and services to assist developers. APDA, Apple's source for developer tools, and Apple Developer University are open to anyone who wants access to development tools and instruction. Developers may access additional information and services through Apple's Developer Programs.

APDA offers convenient worldwide access to development tools, resources, training products, and information for anyone interested in developing applications on Apple platforms. Customers receive the quarterly *APDA Tools Catalog* featuring over 200 Apple and third-party development products. There are no membership fees. APDA offers convenient payment and shipping options, including site licensing.

Apple Developer University (DU) provides software development courses designed to increase your development productivity. The curriculum includes courses to get you started programming on Apple platforms, as well as advanced, in-depth training on the newest Apple technologies, such as PowerPC, AOCE, QuickDraw GX, and Newton. DU offers courses in Cupertino CA and at selected training locations. The DU Extension partners located in Plano TX and Portsmouth NH also schedule selected courses in their facilities. In addition to classroom training, DU offers multimedia self-paced courses and low-cost mini-course tutorials.

The Associates Program is Apple's primary program for developers across all Apple technologies, including Macintosh, Personal Interactive Electronics (such as Newton), and multimedia. It's a low-cost, self-support program that also provides a connection with Apple and fellow developers, information on new technologies, and discounts on equipment.

The Apple Multimedia Program is designed for developers interested in the emerging multimedia market. Program features include a quarterly mailing and discounts on third-party products, training, and events.

The Macintosh Technology Partners Program is open to Apple-selected strategic developers focused on Macintosh technology, including PowerPC, QuickTime, QuickDraw GX, and PowerTalk. In addition to receiving the same development information and tools as members of the Associates Program, Macintosh Technology Partners receive programming-level development support via electronic mail. Membership in this program is limited to strategic developers who directly contribute to Apple's long-term product plans and business objectives.

The PIE Partners Program is open to Apple-selected strategic developers focused on Personal Interactive Electronics. It offers the same core features as the Associates Program, but also includes programming-level development support via electronic mail, additional hardware purchasing privileges, marketing programs, and media production assistance.

APDA To order products or to receive a complimentary catalog, call 1-800-282-2732 in the U.S., 1-800-637-0029 in Canada, (716)871-6555 internationally, or (716)871-6511 for fax. You can also order electronically (AppleLink APDA; Internet APDA@applelink.apple.com; CompuServe 76666,2405; or America Online APDA) or write APDA, Apple Computer, Inc., P.O. Box 319, Buffalo, NY 14207-0319.

Apple Developer University The registrar at (408)974-4897 can reserve your place or send a current Curriculum Guide and Course Schedule. You can also send an AppleLink to DEVUNIV or write Developer University, Apple Computer, Inc., 20525 Mariani Avenue, M/S 305-1TU, Cupertino, CA 95014. Self-paced products should be ordered directly through APDA.

Apple Developer Programs Call the Developer Support Center at (408)974-4897, AppleLink DEVSUPPORT, or write 20525 Mariani Avenue, M/S 303-2T, Cupertino, CA 95014, for information or an application form. Developers outside the U.S. and Canada should instead contact the Apple office in their country for information about developer programs.